intense thunderstorm and tornado? The cold air which was over the Piedmont around Lynchburg could not have ridden back over the advancing southwest wind and produced a thunderstorm coming apparently *from* the southwest. Anyway, there is normally little opportunity for such cold surface air to get above any of the over-running warm air.

The most reasonable explanation seems to be that the cold air remained in the valley behind the Blue Ridge for an hour or two after it was blown off the Piedmont, and that when this cold air was pushed out bodily, beginning in the southwest, it spilled over the Blue Ridge on top of the much warmer wind on the Piedmont. The storm produced in this way might be exceptionally intense and would be confined to a relatively small strip of moderate length. At Lynchburg the rain from this storm amounted to 0.58 inch from 9:05 to 11:45 p. m., and it was followed later by a characteristic shower of 0.13 inch on the arrival of the wind-shift line.—*C. F. Brooks.*

ABNORMAL CHANGE OF AIR TEMPERATURE AT TOKYO AND SINAGAWA.

By K. SIGETOMI

[Abstract.]

In the August, 1918, issue of the Journal of the Meteorological Society of Japan (pp. 49–54) there is an account of abnormal changes of air temperature at a number of Japanese stations on March 20, 1918. At Sinagawa, 9 km. south of Tokyo, the temperature rose 7.8° C. in 50 minutes, and there was a smaller change at Tokyo. An extreme case is mentioned in which the rise was 9.8° C. in 20 minutes at Tokyo in 1912. On March 20, 1918, the land was overlain by a cold wedge of air, thickest in the north; and above this cold air there was a warm current from the south. As the outer margin of this cold mass of air varied back and forth; there were correspondingly extreme changes in temperature—now to the warmth of the southerly wind and then to the cold of the northerly one. The morning weather map and the thermograph and wind records at 10 stations are reproduced.

Discussion.—Sudden rises in air temperature not infrequently accompany the arrival of a warm wind, the lower boundary of which has gradually descended till it reaches the surface with apparent abruptness. Similarly, if a wedge of cold air is slowly pushing under a warm wind, there will be an abrupt fall in temperature when the cold air arrives. On the boundaries between such currents there is usually a mixture fog. The persistence of the occurrence of such abrupt changes for a period of many hours shows how slowly two currents of air of radically different temperatures affect one another when the denser one is below the lighter. For some notes on similar occurrences in the United States, see (1) page 463 of this issue of the REVIEW, (2) note on Three ice-storms, Science, August 8, 1913, and (3) Ice storms of New England, Annals, Obs. Harv. Coll., volume 73, part 1, 1914.—*C. F. B.*

MAJOR CONTROLS OF THE CLIMATES OF THE UNITED STATES.[1]

By ROBERT DE C. WARD, Professor of Climatology, Harvard University.

Climate in general.—Climate is accurately and briefly defined as *average weather.* But means, or averages, may be made up of very different values of the elements which go into them, and therefore a satisfactory presentation of climate must include more than mere averages. It must also take account of regular and irregular daily, monthly, and annual changes, and of the departures, mean and extreme, from the average conditions which may occur at the same place in the course of time. This extension of the definition of climate is especially important in any region where irregular cyclonic variations of weather conditions are frequent, as in the so-called "temperate" latitudes of both northern and southern hemispheres. Therefore, just as weather types change from day to day, and from season to season, under varying controls, so climate is the resultant of many variables. One climate differs from another because of a different combination of these controls. While it is a relatively simple matter to enumerate the factors which combine to produce any given climate, it is difficult, if not impossible, to determine, quantitatively, the relative importance of these different controls, so intimately are they connected and so complex are their effects.

The major controls of climate.—The sun is obviously the fundamental control of climate. The general distribution of temperature over the earth's surface, as well as the diurnal and seasonal changes, depend upon variations in the intensity and in the duration of sunshine. This solar control of climate is commonly known as the control by (1) *latitude*, and stands first. If the sun alone were concerned, all places on the same latitude circle would have the same climate,[2] for the intensity and amount of sunshine depend upon the angle of incidence of the sun's rays, and upon the length of the day, and both of these depend on latitude.

Such a condition is very decidedly modified by the distribution and influence of (2) *land and water;* (3) *mountain barriers*, (4) *altitude*, (5) *prevailing winds*, (6) *ocean currents*, and temporary (7) *storms.* The reaction of the physical features and conditions of the earth's surface upon the atmosphere results is what is termed *physical climate.* According to the dominant control in each case we may have *continental*, *marine*, or *mountain* climates. In the first, land is the essential control; in the second, the ocean; in the third, altitude. An extreme development of the continental type is a *desert* climate. A transitional type between continental and marine, is a *littoral* climate.[3] The relative importance of the above-mentioned major controls of climate, and the types of climate which result from their interaction, inevitably vary greatly in different places according to the geographical location, and the physical, topographic, atmospheric, and other conditions peculiar to each district. For the United States the outstanding facts regarding each of these major controls are here briefly stated.

Latitude.—The difference in latitude between the northern and the southern portions of the United States is the fundamental control which determines the important fact that the mean annual, the seasonal, and the monthly isotherms as a whole show prevailingly lower temperatures in the north than in the south.[4] Yet these isotherms do not run east and west across the continent, as they would were latitude the sole control. Their deflections from the latitude lines show the influence of other controls, such, e. g., as land and water, mountains, ocean currents, winds. If winds have a free sweep across a country they inevitably

[1] Read before the American Climatological and Clinical Association, Boston, Mass., June 5, 1918.

[2] *Solar climate* is the term for a climate which is controlled solely by the amount of solar radiation which any place receives by reason of its latitude alone.

[3] For fuller details regarding the characteristics of these different types of climate, see R. De C. Ward: "Climate considered especially in relation to man," 8°, 2d ed., New York and London, G. P. Putnam's Sons, 1918.

[4] See, e. g., the charts of monthly and annual isotherms in Bartholomew's "Atlas of Meteorology," 1899, Pls. 7 and 8; also the mean annual, January and July isothermal charts in the series of "Climatic Charts of the United States," U. S. Weather Bureau.

wipe out climatic boundaries. They import heat and cold from a distance, and often to a marked degree—sometimes even completely—nullify the effects of latitude. While it is, therefore, impossible to give any quantitative estimate of the importance of latitude as a climatic control sunshine, here expressed by the term *latitude*, must be placed first in the list of major controls.

Land and water.—The influence of latitude may be wholly overcome by the effects of land and water. Land and water are fundamentally different in their behavior regarding absorption and radiation. Land areas, and the air over them, warm and cool readily and to a considerable degree. Water areas, and the air over them, warm and cool slowly, and relatively little. In the same latitudes, disregarding possible permanent differences in cloudiness, the insolation received at the surface on land and water surfaces is much the same. The differences in absorptive power of different land areas, also of water surfaces in various conditions of disturbance or quiescence, may be quite noticeable. However, the absorbed heat penetrates to but slight depths in the case of land surfaces, and because of the low specific heat of earth materials, especially when dry, the surface temperature of land areas increases greatly under insolation. Since the coefficient of radiation is comparable with that of absorption, the loss of temperature under cooling conditions is considerable. In contrast to this, the heat absorbed by water surfaces may penetrate to considerable depths, which, coupled with the very high specific heat of water, causes but slight change of temperature under either heating or cooling conditions.

The larger continental areas of the middle and higher latitudes, therefore, have great seasonal fluctuations in temperature. They are distinctly radical in their tendencies. They absorb much heat, but part with it readily. The oceans, on the other hand, are conservative. They warm but little during the day, and in summer. They cool but little during the night, and in winter. They take in little heat, and part with it reluctantly. Conservatism in temperature is a distinctive feature of marine climates. Another essential difference between oceans and continents is that the waters of the oceans are almost constantly in motion while the lands are stationary.

The temperatures of the oceans in higher and in lower latitudes thus tend to become equalized. This process results in keeping the waters near the Equator from becoming as warm, and those away from the equator from becoming as cold, as they otherwise would be. The land masses, on the other hand, have to take the temperature appropriate to their latitude and season. It follows, therefore, that North America as a whole is cooler in winter and warmer in summer than the adjacent oceans in similar latitudes. This is clearly shown on the isothermal charts for January and July.[5] In the average for the year, the lower latitudes of North America are warmer than the adjacent oceans in similar latitudes, while the higher latitudes are colder. It is obvious that when an isotherm crosses both land and water areas it is likely to be deflected, poleward or equatorward, according to the surface, whether land or water, over which it passes. Differences in climate along the same latitude circle necessarily result.

It has been of very great importance in the history of the United States that the North American continent broadens to the north and narrows to the south and does not become narrower in middle and higher latitudes as South America does. The races which have migrated from Europe to make up the American people have thus been able to spread over a vast extent of country in the Temperate Zone, having climatic conditions not very unlike those of their Old World homes. Were the continent broadest to the south, in the trade wind zone, an American Sahara would replace the Gulf of Mexico and the great agricultural regions of the United States would be correspondingly less extensive. The usefulness of North America as a new home for the overflowing populations of Europe would under such conditions have been very greatly restricted.

The relative preponderance of land or of water influences depends upon a number of factors, such as distance from the ocean; the direction of the prevailing winds; the presence of mountains in the way of onshore winds, etc.. In the United States, the controlling water areas are (*a*) the Pacific and (*b*) the Atlantic Oceans; (*c*) the Gulf of Mexico, and, to a much less degree, (*d*) the Great Lakes. Neither of the two oceans can attain its maximum control over the climate of the adjacent continent—one, the Pacific, because of the presence of the massive mountain barrier near the coast; the other, the Atlantic, because it is on the leeward side of the continent. In the narrow Pacific coastal slope the climates are unlike those elsewhere in the country, and in many respects resemble those of western and southern Europe. Being exposed to the influence of the Pacific, with the prevailing winds blowing directly from the conservative ocean, the climates are on the whole relatively mild and equable, with slight seasonal fluctuations. The seasonal contrasts are most marked where the marine influence is lessened, as in the valleys to the east of the Coast Range. The Slope thus has various types of transitional littoral climates, with increasingly marked continental features over the sections which are most effectively shut off from the ocean influences.

The influence of the Atlantic Ocean is much diminished by the fact that the "prevailing" winds are offshore. Hence it follows that there is not very much of the tempering effect usually associated with the conservative ocean waters. The Atlantic coastal belt, except when the winds temporarily blow onshore, does not differ very much from the interior. This is clearly seen on the chart of mean annual ranges of temperature. Fairly large ranges, characteristic of a continental interior, are carried eastward to the coast, and, even over the ocean, for some distance offshore.[6] Thus the summers are warm along the Atlantic coast, and the winters are cold. The climate is not littoral; it is continental. The Southern States naturally have milder winters than do the States along the northern Atlantic coast, owing to the lower latitudes and the greater frequency of warm winds in the south. The importance of the Atlantic Ocean as a source of water supply is, however, very considerable. To the water vapor brought from the Atlantic by easterly storm winds the abundant and well-distributed rainfall of the Eastern States is largely due. The increase in the mean annual rainfall from the interior toward the Atlantic Ocean, and the general parallelism of the rainfall lines with the Atlantic coast, indicate that much of the water vapor must be supplied from this ocean.

The Gulf of Mexico is an important control of the climates east of the Rocky Mountains. It occupies latitudes which in the Old World include the Desert of Sahara. It is a very warm body of water.[7] Its maxi-

[5] See footnote, p. 464.

[6] See Atlas of Meteorology, pl. 2, text p. 8.

[7] The mean surface temperature in February averages between 68° and 77°, and in August, between 82.5° and 84°.

mum effects are seen during the summer months, for then the prevailing winds over most of the eastern United States are from southerly (SE., S., SW.) directions. These winds are well laden with vapor, and it is to them that much, if not most, of the summer rainfall over this eastern area is due. Furthermore, throughout the year and especially in winter, temporary warm and damp winds associated with passing storm (cyclonic) conditions, blow with considerable frequency from southerly directions, and thus carry the warming influence of the Gulf of Mexico far northward. These warm spells temper the winters of the northern districts, interrupting the severe cold that comes with the westerly and northwesterly winds from the northern continental interior. In summer, these southerly spells are hot, muggy, and depressing. The sharp contrast between the weather type which is associated with cold northerly winds, and that which comes with warm southerly winds from the Gulf, is one of the striking and characteristic features of the climates of much of the great region east of the Rocky Mountains.

The Great Lakes are of relatively subordinate importance as major climatic controls, but they show local effects which are in many cases of distinct economic significance. The lee shores in several cases show heavier annual rainfalls than the windward shores, but the excess is relatively rather slight, being generally not over 5 inches. The effect is probably greatest in the case of Lake Superior. Local topography is here, as always, an important factor in controlling the amount of rainfall. The belt between the 30-inch and the 35-inch mean annual rainfall lines shows a rather significant widening toward the Lakes. This fact, together with the general trend of these, and other, rainfall lines in the Great Lakes region, indicates that the Lake influence is present, although not very striking. The rain-bearing winds in this district are to a considerable extent from easterly directions, and for that reason the slight difference in rainfall between windward and leeward shores is not surprising. In winter, when the cold westerly winds sweep across the open waters of the Lakes, the snowfall on the lee shores is distinctly increased. Other effects of the Great Lakes are the decreased intensity of severe winter cold waves resulting from the tempering influence of the water; the later occurrence of the first killing frost of autumn and the earlier date of the last killing frost of spring in favored localities, as in the famous Chautauqua grape belt; the development of onshore lake breezes on fine hot summer days, as studied at Chicago; a local increase in cloudiness and in relative humidity, and some other minor effects. Details concerning these conditions belong in a study of local climates, and are out of place in a very broad consideration such as the present one.

Mountain barriers.—Mountain ranges, especially high and extended mountain ranges, are effective climatic barriers. If they stand in the path of the prevailing winds they may bring about marked differences in rainfall; in temperature; in cloudiness; in humidity, on their opposite sides. When near a coast, especially a windward coast, they prevent ocean influences from extending inland.

The most important mountain barrier in the United States is that formed by the Pacific Coast ranges (Cascades, Sierra Nevada, Coast). These western mountains prevent the influence of the Pacific from being carried far into the continent, and thus separate a narrow coastal belt, much of which has a modified marine climate, from an interior east of the Sierra Nevada-Cascades, where the rainfall is less and the ranges of temperature are much greater. The influence of the western barrier upon the climates of the North American continent as a whole is accentuated by the fact that the mountain systems trend in a northwesterly direction in the higher latitudes, where the continent broadens, thus limiting the marine influences still further to the more immediate Pacific coast. The situation is quite different in Europe, where there are no high west coast mountains and where for this reason, and because the windward margins of the continent are much indented by numerous water bodies, the ocean influence is carried far inland by the prevailing westerly winds. The Rocky Mountains, together with their collateral ranges, are far less important as a climatic barrier than they would be were there no Pacific ranges. The latter being farther to windward naturally have the greatest effect. The influence of the Rocky Mountains is seen in their local effects upon rain and snowfall; in their acting as a barrier against the spreading of cold waves over the Plateau region from the east; in the warming which bodies of air undergo as they descend the slopes (chinook winds); in the differences which often prevail between the weather types to the east and west of the continental divide, and in other ways.

The Appalachians as a whole are not an effective barrier. They are not high. They are near the leeward margin of the continent. They are more or less parallel to the direction of the prevailing winds during much of the year. The amounts of rainfall on their eastern and western slopes do not, taking the system as a whole, show very marked and persistent differences. Even in winter they do not protect the districts to leeward from invasions of continental cold. The Appalachians do, however, show many local barrier effects upon the climates of their immediate surroundings. The fact that the lesser mountain barrier is on the east of the continent and the greater barrier on the west, made it easy for the early settlers to cross the Appalachian area through the natural gateways, and then to expand over the great interior lowlands, where they found favorable climatic conditions.

It is one of the striking characteristics of the topography of the United States that there is no great transverse (i. e., east and west) mountain barrier. In going from south to north, or vice versa, no sudden changes in climate are met with. The gradations are slow and gradual. The climatic subdivisions are, therefore, separated by meridianal, and not by latitudinal, lines. The influence of the Gulf of Mexico would be much diminished if there were a transverse range of high mountains across the Mississippi valley. Such a range would cut off from the districts to the north of it the warm southerly winds and the rainfall which now have free access from the Gulf. The severity of the winters would, therefore, be considerably increased over the northern tier of States east of the Mississippi River. A transverse mountain range, on the other hand, would be a great protection to the Southern States in winter, in keeping out the cold northwest winds, which now have a free sweep from the western plains of Canada to the Gulf, and often cause great damage to crops in the far south. The significant fact concerning the topography of the eastern United States as a whole is its uniformity. There is some analogy here with the conditions over much of Europe, where the mild and damp southwesterly winds from the warm Atlantic temper the winters in a similar though much more marked way.

The fact that the western mountain barriers largely prevent the importation of water vapor from the Pacific Ocean into the interior of the country adds very greatly to the importance of the control which the Gulf of Mexico can exert over the rainfall of the eastern United States in the absence of any transverse mountain barrier. From the Gulf comes an abundant supply of rainfall, which to a large extent compensates for the loss resulting from the presence of the western mountains. Were there no western mountain barrier, the Gulf, while still of importance, would be a less critical control. In Europe, where high western mountain ranges are lacking, the supply of water vapor from the Atlantic is freely distributed to the eastward, over the continent. There is, therefore, no such need of an auxiliary supply from the Mediterranean. If there were no Gulf of Mexico, or if there were a high transverse mountain barrier across the Mississippi Valley, the rainfall over much of the United States east of the Rocky Mountains would doubtless be far less favorable for agricultural purposes and for the homes of a large population. Indeed, it is probable that semi-aridity might to a considerable extent replace the present sufficient and well-distributed rainfall over much of our best farming land.

Altitude.—The barrier effects of mountains are simply due to the obstacle that mountain ranges put in the way of climatic conditions, which would otherwise be similar on the opposite sides of the barrier. A narrow wall, as high as the respective mountain ranges, would accomplish essentially the same results. In addition to this simple barrier effect, mountains and highlands have certain special climatic peculiarities because of their elevation above sea level. It is here that the control of climate by *altitude* is met. Mountain and plateau climates are always placed in a group by themselves as distinguished from those of lowlands. The former, as contrasted with the latter, are characterized by a general decrease in pressure, temperature, and absolute humidity, an increased intensity of insolation and radiation, larger ranges in soil temperature, higher wind velocities, usually a greater frequency of rain and snow and, up to a certain altitude, more of it. "Inversions of temperature" (i. e., where the temperature increases with increasing altitude) are frequent characteristics of the colder months and of the night. Such conditions often give mountains the advantage of higher temperatures than the adjacent valleys or lowlands—a fact of importance in connection with the use of certain mountain stations as winter resorts. In summer, altitude gives relief from the heat of the lowlands.

Broad generalizations such as these serve only for the purposes of a very brief summary. The local topography is of prime importance in bringing about many modifications in climatic conditions. Mountains both modify the general and give rise to local winds. Among the latter, the well-known mountain and valley winds are often of considerable hygienic importance in their control of the diurnal period of humidity, cloudiness, and rainfall. In the United States the greatest and most widespread effects of altitude are naturally found in the western plateau and mountain region, where the varied topography gives rise to a great variety of local climates. In the east the elevations are less, and the area occupied by highlands is less extended. Nevertheless, there are many well-known conditions which result from the presence of mountains. Among these may be mentioned, as illustrations, the heavy rainfalls of the eastern and southern slopes of the southern Appalachians; the popularity, as summer resorts, of the White Mountains of New England, the Adirondacks of New York, and many other portions of the mountain and plateau country along the Atlantic seaboard. If there had been no Appalachian highland area in the Southern States, with its plateaus and slopes unsuited to the growth of tobacco and cotton and sugar cane, these typical southern crops, and the negro labor which they necessitate, would doubtless have occupied much of the area which, with its more "temperate" plateau and mountain climates, was actually settled by a very different sort of population, engaged in different occupations.

Prevailing winds.—Most of the United States lies in what is generally known as the belt of the storm-bearing "prevailing westerly winds." To the south, the States bordering on the Gulf of Mexico, already subtropical in latitude, share also in the wind system which is characteristic of tropical countries, viz, the trades. These trade winds, like the "prevailing westerlies," find their initial cause in the great permanent differences of temperature and of pressure between equator and poles, but are greatly modified by local pressure distribution. Year by year the orderly succession of the seasons brings a warming and a cooling of the continent. The pressures change systematically, not only over the continent, but also over the adjacent oceans. Sympathetically, also, the prevailing winds show a seasonal change in their directions. Other influences also play a part. The great mountain systems are barriers in the path of the winds. The general configuration of the country—the trend of mountains and of valleys, locations to windward or to leeward of mountains or of lakes, the hour of the day or night, exposure to land or sea breezes, and, more important than all, the varying storm control—all these have a share in controlling the winds, both in direction and in velocity. And as winds are of critical importance in controlling weather types, their direction and velocity, however controlled, are fundamentally important in any study of climate. The "prevailing wind" in summer may be a very warm one, as is the case over most of the eastern United States, where southwesterly wind directions are dominant during the hot months. Such conditions naturally increase the summer heat. Or, the prevailing winter wind may be a cold one, as in New England, thus making the winters more severe. The reversal of the "prevailing westerly winds" under the control of passing conditions of high or low pressure is so frequent that many persons, especially along or near the northern Atlantic coast, find it difficult to believe that the "prevailing winds" are actually from the west. Easterly storms, easterly winds blowing on shore from a high pressure area off the coast, even the local and relatively insignificant sea breeze of summer, all combine to keep up this impression.

The great permanent areas of high and of low pressure over the oceans adjacent to North America—the so-called "centers of action"—play a considerable part in determining the directions of the prevailing winds on the continent. The low pressure system over the northern North Atlantic ("Iceland LOW") exerts a marked control over the prevailing northwesterly winds of the northeastern United States in winter. The tropical high-pressure belt of the North Atlantic has an important share in determining the great flow of southerly winds over the southern and eastern portions of the country throughout the year, as well as in controlling the general character of the seasons in the eastern United States. On the Pacific coast, a low-pressure area over the northern North Pacific ("Bering Sea or Aleutian LOW") in winter largely controls the prevailing southwesterly and westerly winds of the northern portion of this coast, while the tropical high-pressure belt lying farther south also influences the wind directions, especially along the southern portion of the coast.

Ocean currents.—Too much emphasis is usually laid on ocean currents as controls of climate. It should be remembered that an ocean current can have practically no influence on the climate of an adjacent land unless the wind is blowing onshore, and further that ocean waters in themselves, without the help of any ocean currents, are conservative bodies, and, therefore, tend to temper the cold or the heat of any land over which their influence may be carried. It is true enough that the Gulf stream and the Gulf stream drift do keep the North Atlantic waters off the eastern coast of the United States warmer than they would otherwise be, and that the Labrador current is a cold flow which chills these same waters to a lower temperature than they would otherwise have. And on the Pacific side, the Japanese current, flowing southeastward along our western coast, with a subordinate eddy circling around the Bay of Alaska, certainly contributes toward keeping the Pacific slope climates rainier and warmer in winter than they would be without that current. A glance at the isothermal charts of the world at once shows the effects of these currents in deflecting the isotherms. Off the Pacific coast of North America, the isotherms are carried equatorward by the southward-flowing current passing along California and Mexico, and poleward by the eddy which flows from right to left around the Bay of Alaska. The result is a spreading apart of the isotherms and a tendency toward an equalization of the temperatures along the coast. On the Atlantic side, on the other hand, the isotherms are crowded together. The Gulf stream carries them northward along the southern and central portions of the coast, while the Labrador current carries them southward along the coast of New England and the Canadian Provinces. Hence there is a very rapid decrease of temperature northward along the Atlantic coast, which amounts to 2.7° F. per latitude degree in January.

Storm control.—In the "Temperate Zones" the weather is largely controlled by a succession of low and high pressure areas ("cyclones" and "anticyclones"), more or less irregular in their occurrence; uncertain in their progression and direction; and differing considerably in their characteristics. Hence, weather changes are correspondingly irregular, uncertain, and diverse. Of weather types there is an almost endless variety. These different types give our climates their distinctive characters, and to a large extent determine the amount and distribution of temperature; of rain and snow; of humidity; of cloudiness. Cyclones and anticyclones are, therefore, essential controls of climates in the latitudes of the "prevailing westerlies." Over the Temperate Zones as a whole there is a great ring of stormy weather, oscillating poleward and equatorward as the sun moves to and fro in the course of its regular migration. In winter, practically the whole of the United States is under the influence of this storm belt. Storms are not only more widely distributed then, but they are also larger, more frequent, more violent, and move faster than in summer. Hence, all changes of wind, temperature, and weather occur oftener, are more sudden and more emphatic at that season. In summer, when the general storm belt swings to the north, the storm element in our weather changes is weakest. The dominant weather types are chiefly associated with the regular changes from day to night. Periodic, diurnal phenomena replace nonperiodic, cyclonic phenomena. The detailed study of weather types is not a part of ordinary climatological investigation. Yet anyone who seriously attempts to study the climatology of the United States should have a series of weather maps in one hand, and a set of climatic charts of the country in the other. He will soon realize that the better his understanding of the former, the more intelligent is his appreciation of the latter.